May 16, 2008

M E M O R A N D U M

TO: Peter Wagner, Administrator, Boise Regional Office
Richard Huddleston, Wastewater Program Manager, State Office

FROM: Mark Mason, Boise Engineering Regional Manager

SUBJECT: **Staff Analysis of the CTI-SSI Food Services, LLC Industrial Wastewater Reuse Permit Renewal, LA-000095-03 (Industrial Wastewater)**

Purpose

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17, Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater" (Reuse Rules) Section 400.04 for renewing wastewater reuse permits.

Process Description

The CTI-SSI Food Services (SSI) facility processes meat products for the commercial food industry. Most of the wastewater that is reclaimed for reuse (reclaimed wastewater) is generated by routine cleanup activities and equipment sanitation operations. The wastewater contains both raw and cooked meat particles along with fats, oils, and grease (FOG). The wastewater is collected and piped to a dissolved air flotation (DAF) system that includes a rotary drum screen for removing large solids and a DAF clarifier for removing small solids and FOG. The removed solids and FOG are dewatered and sent offsite to a rendering facility. Effluent from the DAF system is sent to a sump.

A secondary source of reclaimed wastewater is from parking lot wash-down and truck wash operations. That water is collected in a large lined (estimated 60-mil HDPE) plant-site storage pond. Two smaller ponds that originally were connected to the large pond will be positively isolated and rehabilitated as part of an on-going compliance activity. The small ponds will not be part of the reclaimed wastewater reuse system in the renewed permit.

From the plant sump, the reclaimed wastewater is pumped approximately three miles to the reuse site. The water normally reports to another sump and then is pumped directly to where it is land applied. The water can also be directed to either of two reuse-site lagoons where it can be stored and mixed as required with supplemental water from two irrigation wells. Water from these lagoons is returned by gravity to the reuse-site sump. Water can be pumped from that sump to irrigate all of the fields and adjacent areas (pivot corners) covered under the renewed permit.

Supplemental irrigation water can also be applied directly to all of the fields and one of the seven adjacent pivot corner areas as noted in the following table:

Field or Area	Source of Supplemental Irrigation	Comments
CP-N	Irrigation Wells	Pressure
CP-S	Irrigation Wells	Pressure
CP-17B	Arena Canal [b]	Gravity
F-N[a]	Arena Canal [b]	Gravity
CP-17B1 (pivot corner area)	Arena Canal [b]	Gravity

[a.] Reclaim water application limited to emergency only with prior approval
[b.] Normal method of irrigation, but groundwater from Irrigation Wells can also be applied through the pressure irrigation system

Irrigation water to the four CP-N and two CP-S pivot corner areas can only be supplied by pumping from the reuse-site sump.

Summary of Events

SSI Food Services, Inc. initially land applied wastewater on the 14-acre "Plant Site". A permit application for this land was submitted to DEQ in November 1989. Fields CP-N and CP-S (116 acres each) were added to the land application program in 1993. In February 1994, Land Application Permit LA-000095-01 was issued for Fields CP-N, CP-S and F-N (36 acres). The permit was later modified to allow for non-growing season land application on Field CP-17B (88 acres).

In June 2003, Land Application Permit LA-000095-02 was issued for fields CP-N, CP-S, CP-17B and seven (7) corner pivot areas (total area of 52.1 acres). The permit prohibited wastewater application to the Field F-N except for emergencies requiring DEQ's prior approval. This permit was modified in October 2003 to reflect the name of the new owner and operator of the facility, CTI-SSI Food Services, LLC. A second modification in July 2004 deleted three (3) of the original monitoring wells and added two (2) new ones. A third modification in September 2005 increased the allowable non-growing season hydraulic loading rates for CP-N, CP-S and CP-17N, provided non-growing season loading rates for F-N and the Pivot Corner Areas (with use of F-N still restricted to emergencies only) and changed some monitoring requirements. A fourth modification in August 2007 allowed earlier spring soil sampling in order to facilitate more timely application of supplemental nutrients.

At this time, all compliance activities associated with the current (LA-000095-02) permit have been completed except for CA-095-07, Rehabilitation of Small Plant Site Lagoons. SSI is actively working with DEQ to finalize the rehabilitation plan.

Discussion

General Information

The land application site consists of the following fields and acreage:

Field	HMU[a]	Acres	Recommended as Acreage for Wastewater Land Application in Renewal Permit
CP-N	MU-009501	116	Yes
CP-S	MU-009502	116	Yes
F-N	MU-009503	36[b]	Emergency use only
Seven (7) Pivot Corner Areas: CP-N1 (SE),2 (NE),3 (NW),4 (SW); CP-S1 (NE),2 (NW); CP-17B1 (NW)	MU-009505	37.1[c]	Yes
CP-17B	MU-009506	88	Yes

[a.] HMU-009504 is a former wastewater application site that has been decommissioned.

[b.] Per the current permit, land application of wastewater on Field F-N is reserved for emergency use to prevent exceeding non-growing season hydraulic limits on the other fields.

[c.] The total pivot corner area has been reduced from 52.1 to 37.1 acres to reflect the use of pivots in place of hand lines for irrigating all of these areas except CP-N1.

The total acreage for reclaimed wastewater reuse in renewal permit LA-000095-03 is 357.1 acres (CP-N, CP-S, Seven Pivot Corner Areas, and CP-17B).

Staff recommends that the renewed permit include the option in the current permit for applying reclaimed wastewater to the F-N field in an emergency with DEQ's prior approval.

Staff prepared this analysis based on information from the 2006 and earlier annual reports. The analysis was substantially complete when DEQ received the 2007 Annual Report.

Soils

The soils at the reclaimed water reuse site are deep well-drained, loamy sands. U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) soil survey data indicate that the site is dominated by loamy fine sand. None of the data collected since sampling began in 1994 suggest that other soil types might be present.

Soil samples have been collected and analyzed for key agronomic properties and constituents semi-annually since 1994. The data shows some of these parameters to be elevated, but still within acceptable limits for the types of crops being grown. No adverse trends were identified. SSI is working to reduce soil pH. The 2006 soil data show available nitrogen (nitrate and ammonium) ranging from 3 to 8 parts per million (ppm). Excluding Field F-N, phosphorous concentrations ranged from 7 to 23 ppm and soil salinity from 0.6 to 1.1 millimhos per centimeter. Based on the soil chemical data, this site is suitable for continued use of reclaimed wastewater to irrigate crops.

Staff recommends the soil monitoring program from the current permit, including the modified earlier spring sampling period, be continued.

Groundwater

General

The aquifer under the reuse site is considered to be unconfined, generally consisting of a 30 to 200-foot-deep strata of fine sand to coarse sand and gravel. Lenses of clay and sandy clay west of the reuse site appear to be relatively localized. The aquifer is underlain by a clay formation.

The groundwater up-gradient, mid-gradient, and down-gradient of the fields are monitored utilizing 17 wells identified as MW-1S through MW-12S, MW-1D, MW-6D, MW-6XD, MW-7SB and MW-10SB. All of the wells are completed in the shallow aquifer. The wells range in depth between 38 and 95 feet below ground surface. The "D" and "XD" labeled wells are slightly deeper than their associated shallow ("S") companion to assess vertical changes in groundwater quality and gradients. All of the monitoring wells have 10 feet of 0.010-inch slotted screen near their bottoms and are filter packed around the screen.

Groundwater levels have been monitored since 1992. All 17 wells currently are used to collect that information semi-annually (May and October). The data show no significant general trends with regard to whether groundwater levels are increasing or decreasing. There appears to be a weak correlation between groundwater levels and annual precipitation. The data show season fluctuation with levels being lower at the start of the growing season then at the end. SSI's analysis that the groundwater in the shallow aquifer flows to the west-southwest with an average horizontal hydraulic gradient of 0.004 feet per foot appears to be correct.

Relative to the west-southwest groundwater flow direction, MW-1S, MW-1D, MW-7S through MW-10S, MW-7SB and MW-10SB are positioned up-gradient of the land application fields. MW-2S and MW-3S are located mid-gradient of the fields (down-gradient of Field F-N and up-gradient of Fields CP-N and CP-S). MW-11S is also mid-gradient of the fields (down-gradient or side gradient of Field CP-17B and

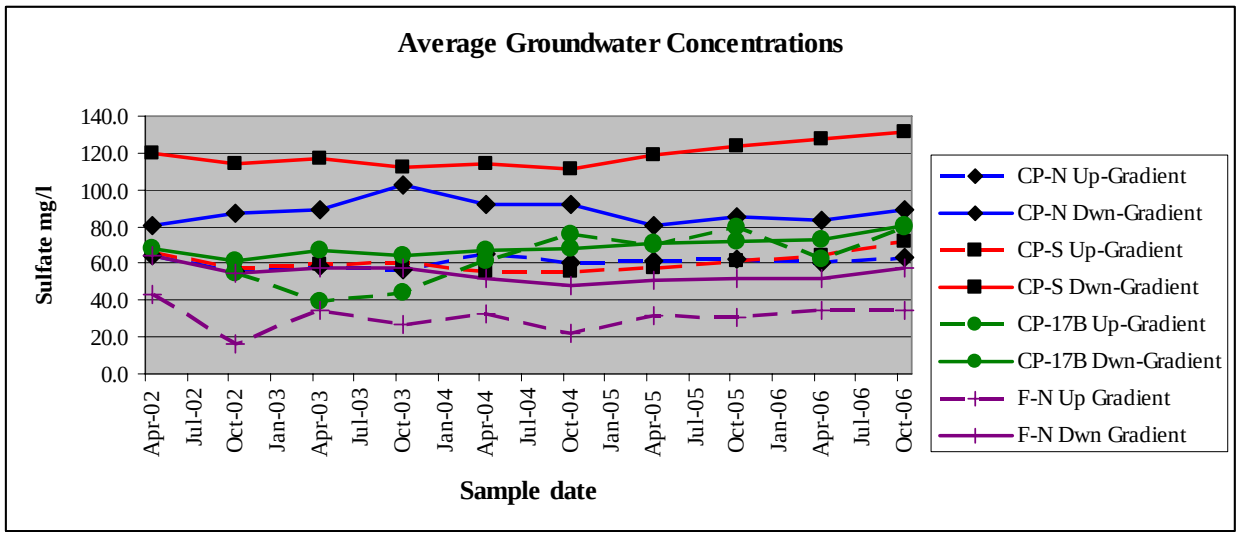
up-gradient of Field CP-S). MW-4S and MW-5S are located down-gradient of Field CP-N and MW-6S, MW-6D, and MW-6XD are located down-gradient of Field CP-S. MW-12S is down-gradient of Field CP-17B and up-gradient of field CP-S.

Groundwater quality has also been monitored since 1992. Twelve (12) wells (all of the groundwater elevation wells except MW-7S, MW-8S, MW-9S, MW-10S and MW-11S) currently are being used to collect that information semi-annually (May and October). Current quality monitoring is for the following 13 parameters: Nitrate-Nitrogen, Total Phosphorous, Total Dissolved Solids (TDS), Total Iron, Total Manganese, Chloride, Sulfate, Dissolved Iron, Dissolved Manganese, Electrical Conductivity, pH and Temperature. Analytical results are only required for Dissolved Iron/Dissolved Manganese if the Total Iron/Total Manganese concentrations exceed the standards in IDAPA 58.01.11, Ground Water Quality Rule, Section 200.01.b. The following table presents the up and down-gradient wells associated with each field.

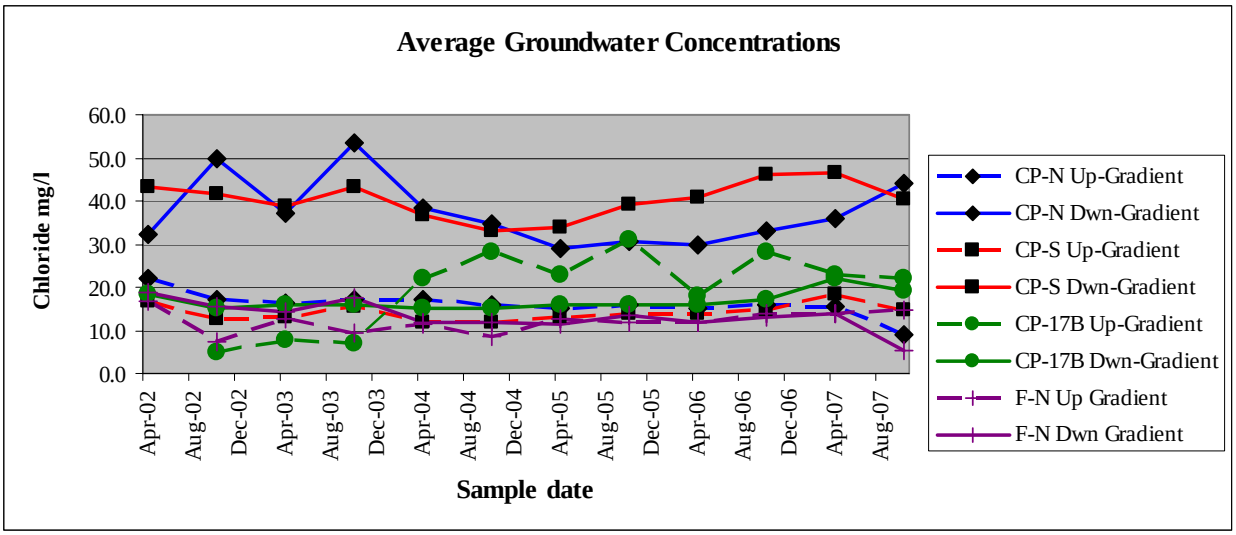
Field	Up-Gradient Wells	Down-Gradient Wells
CP-N	MW-7S/SB[a] + MW-3S	MW-4S + MW-5S
CP-S	MW-2S + MW-12S	MW-6S, MW-6D + MW-6XD
CP-17B	MW-10S/SB[a]	MW-12S
F-N	MW-1S +MW-1D	MW-2S +MW-3S

[a.] The SB wells replaced the S wells in the spring of 2004

Over the past five years ending in 2006, sulfate and chloride groundwater concentrations have remained below IDAPA 58.01.11, Ground Water Quality Rule (GWQR) standards (250 mg/l for each). The following figures present curves of the average up and down-gradient sulfate and chloride concentrations respectively for each field between 2002 and 2006. Up-gradient curves are dashed lines and down-gradient curves are solid lines. Curves for each field have the same color and symbols.



The up and down-gradient groundwater sulfate concentrations for the three active fields appear to slightly increase over time. The up and down-gradient F-N groundwater concentrations have no apparent trends. The vertical separation between the up and down-gradient curves for each field suggests how much sulfate the groundwater picks up (or loses) as it traverses under that field. Groundwater sulfate concentrations for CP-N, CP-S and F-N appear to increase by approximately 25 mg/l, 60 mg/l and 20 mg/l respectively. Reclaimed water reuse operations at the newer CP-17B do not appear to be currently contributing to the sulfate in the groundwater traversing beneath that field.

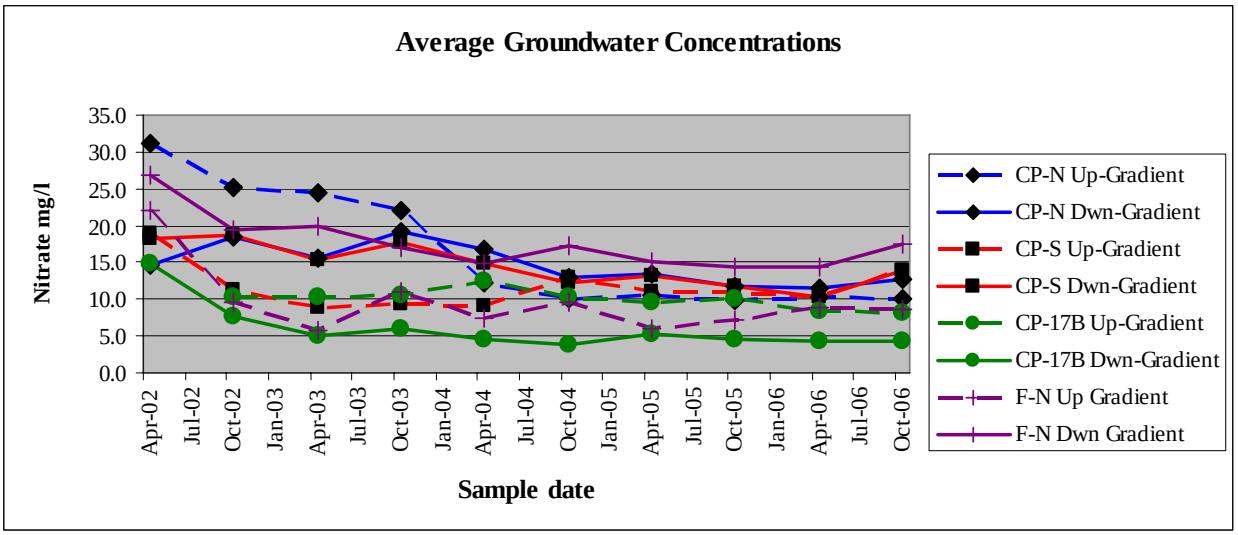


The up-gradient groundwater chloride concentrations for CP-N and CP-S appear to be decreasing slightly and the down-gradient concentrations remaining fairly constant. The up and down-gradient F-N groundwater concentrations appear to be decreasing. The up-gradient CP-17B concentration is increasing whereas the down-gradient concentration is remaining steady. The vertical separation between the up and down-gradient curves for each field suggests how much chloride the groundwater picks up (or loses) as it traverses under that field. Groundwater chloride concentrations for CP-N and CP-S appear to increase by approximately 15 mg/l and 25 mg/l respectively. No increase occurs for F-N. For the last part of the period, groundwater appears to have lost chloride as it traversed CP-17B.

pH has exceeded the GWQR standard range (6.5 to 8.5) three times, all in the fall of 2002. Those exceedences may have been erroneous and are not considered significant. Iron and manganese have occasionally exceeded GWQR standards (0.3 mg/l and 0.05 mg/l respectively), but have done so in a random fashion with exceedences occurring as often at up-gradient wells as at down-gradient ones.

Nitrate Concentrations

During the five year period, the GWQR standard for nitrate of 10 mg/l was exceeded consistently. The following figure presents curves of the average up and down-gradient nitrate concentrations for each field between 2002 and 2006. Up-gradient curves are dashed lines and down-gradient curves are solid lines. Curves for each field have the same color and symbols.



Field CP-N – Up and down-gradient nitrate concentrations decreased initially, but had leveled off at or slightly above the GWQR standard by the end of the period. There is only a small vertical separation between the curves, indicating that reclaimed wastewater reuse operations on CP-N have little effect on groundwater nitrate concentrations.

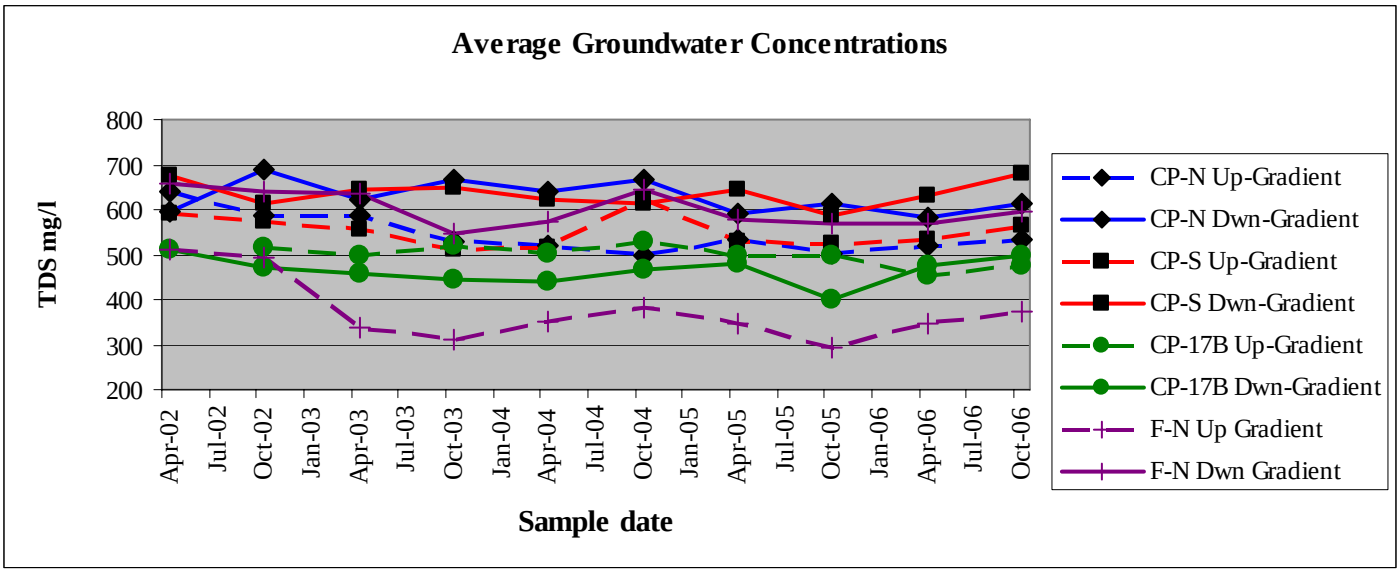
Field CP-S – Up and down-gradient nitrate concentrations decreased initially, but appear to have leveled off at or above the GWQR standard by the end of the period. There is only a small vertical separation between the curves, indicating that reclaimed wastewater reuse operations on CP-S have little effect on groundwater nitrate concentrations.

Field F-N – Up and down-gradient nitrate concentrations decreased initially, but appear to have leveled off by the end of the period. The approximate 6 mg/l vertical separation between the curves suggests that nitrate is still being flushed out of the soils beneath the now inactive field.

Field CP-17B – The up-gradient groundwater nitrate concentration has remained constant at approximately 10 mg/l during the period while the down-gradient concentration initially decreased than leveled off at about 5 mg/l.

TDS Concentrations

During the five year period, the GWQR standard for total dissolved solids (TDS) of 500 mg/l was exceeded consistently. The following figure presents curves of the average up and down-gradient TDS concentrations for each field between 2002 and 2006. Up-gradient curves are dashed lines and down-gradient curves are solid lines. Curves for each field have the same color and symbols.



Field CP-N – Up-gradient TDS concentrations decreased slowly over the period to about 550 mg/l. Down-gradient concentrations initially increased and then returned to about 600 mg/l. The approximate 50 to 100 mg/l vertical separation between the curves suggests that reuse operations at CP-N contribute to TDS in the groundwater.

Field CP-S – Up-gradient TDS concentrations fluctuated between 500 and 600 mg/l during the period but do not appear to be increasing in the long term. Down-gradient concentrations fluctuated between 600 and 700 mg/l and also do not appear to be increasing in the long term. The approximate 75 to 150 mg/l vertical separation between the curves suggests that reuse operations at CP-S contribute to TDS in the groundwater.

Field F-N – Up-gradient TDS concentrations decreased from 500 mg/l at the beginning of the period and then leveled off to below 400 mg/l. Down-gradient concentrations fluctuated between 550 and 650 mg/l during the period with a slight decreasing trend. A 200 mg/l vertical difference between the curves suggests that flushing of the soil beneath the now inactive field is still occurring.

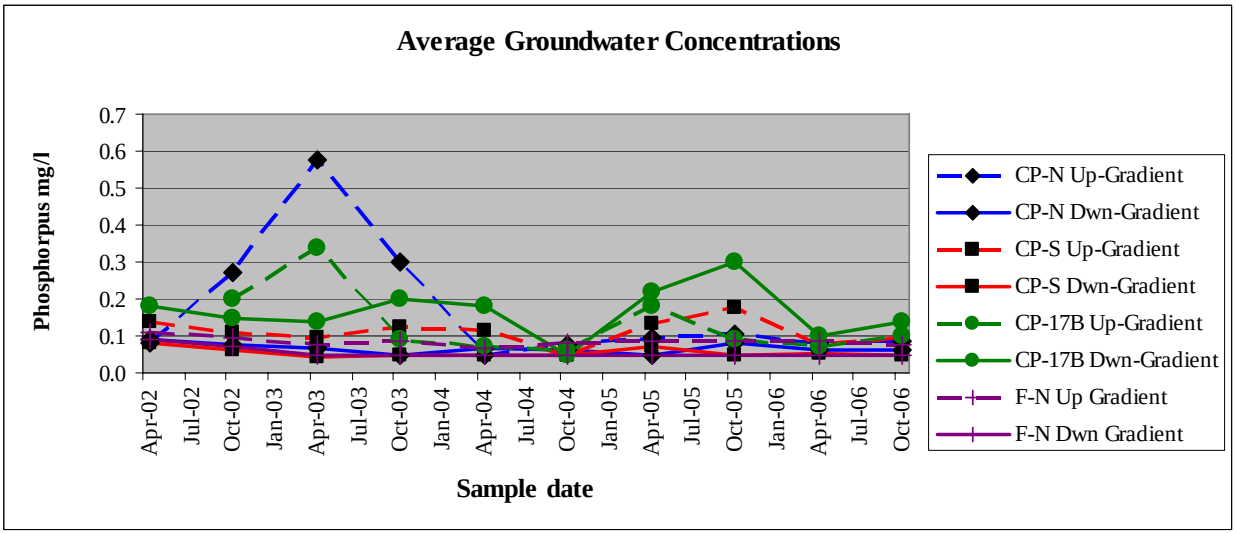
Field CP-17B – Up-gradient TDS concentrations have fluctuated around 500 mg/l with a slight decreasing tendency. Down-gradient TDS concentrations were initially below up-gradient ones, but began rising during the last three years and are now above them. There is only a small vertical separation between the curves, indicating that reclaimed wastewater reuse operation on CP-17B currently has little effect on groundwater TDS concentrations.

In summary, the up-gradient and down-gradient groundwater nitrate and TDS concentrations exceed GWQR standards. The up-gradient concentrations of nitrate and TDS appear to reflect an area-wide groundwater problem not caused by the reclaimed water reuse operation. Up and down-gradient groundwater quality improvements with regard to nitrate and TDS concentrations were observed at the beginning of the last five year period. However, these improvements appear to have stopped with the concentrations remaining constant over the last 2 or 3 years. Further improvements appear to be limited by up-gradient groundwater quality. Groundwater traversing under CP-N and CP-S appears to experience little or no increase in its nitrate concentrations, but does experience a notable increase in TDS concentrations. Groundwater traversing under CP-17B appears to experience little or no increase in either nitrate or TDS concentration. Groundwater appears to still be flushing excess nitrate and TDS from the

soil beneath the now inactive F-N.

Phosphorous Concentrations

The following figure present curves of the average up and down-gradient phosphorous concentrations for each field between 2002 and 2006. Up-gradient curves are dashed lines and down-gradient curves are solid lines. Curves for each field have the same color and symbols.



There is no GWQR standard for phosphorus. However, the current permit requires groundwater monitoring for phosphorus because of its deleterious effect on surface water quality and the potential of the groundwater's eventually interfacing with surface water. The data collected between 2002 and 2006 show that up-gradient phosphorus concentrations are generally higher than down-gradient ones. The one exception is that phosphorous concentrations of the groundwater traversing under CP-17B (between MW-10SB and MW-12S) tend to increase slightly, but those concentrations then decrease significantly as the water traverses under CP-S (between MW-12S and MW-6S, D and XD). The reason for the observed concentration decreases is unknown. Groundwater down-gradient of CP-N and CP-S has phosphorous concentrations less than 0.10 with no observed increasing trends.

Permits typically require compliance with the standards contained in the GWQR. However, since the up-gradient groundwater already exceeds those standards for nitrate and TDS, the focus of the permit needs to be directed to minimizing any additional impacts the reclaimed wastewater reuse operation might have on groundwater quality. In that regard, staff notes that recent data suggests that TDS, sulfate and, to a lesser degree, chloride concentrations are increased as groundwater traverses beneath the reuse sites. Considering that nitrate and TDS concentrations are above GWQR standards, staff recommends that the special nitrate and TDS monitoring activity from the previous permit be continued in the renewed permit and expanded to include sulfate and chloride. That activity requires SSI to provide an annual statistical analysis of groundwater quality results, using protocols approved by DEQ, to report groundwater quality trends for the constituents being monitored. This analysis provides a means for routine evaluation of area groundwater quality and gives DEQ a basis for making adjustments, if necessary. The land application site is located in the Lower Boise/Canyon County groundwater nitrate priority area and in the future, local stakeholders may develop a groundwater management plan for this area.

Staff recommends that groundwater monitoring as set forth in the current permit be continued except as noted:

1. Delete groundwater sample temperature as a monitoring parameter. SSI should measure and record groundwater sample temperature only as required to satisfy the applicable sampling and analytical protocols.
2. Delete the condition that samples should be analyzed for Dissolved Iron and Dissolved Manganese only if Total Iron and/or Total Manganese concentrations exceed GWQR standards. SSI appears to analyze for Dissolved Iron and Dissolved Manganese regardless of Total Iron and Total Manganese concentrations, so making this change simplifies monitoring requirements and brings the permit requirements in line with actual practice.
3. Include the requirement to perform statistical trend analysis for sulfate and chloride in addition to nitrate and TDS using DEQ-approved procedures.

Surface Water

The Snake River is located approximately one mile to the south of the land application site. The entire site lies above the 500-year floodplain of the Snake River. No canals cross the land application site; the USGS map used as a base map by SSI does not reflect current flow paths of the Arena Canal and the Plowhead Lateral which no longer flow across the land application site. SSI maintains the minimum standard 50 feet buffer distance between land application areas and man-made surface waters.

Loading Limits

Growing Season Crop Hydraulic Requirements

The GS hydraulic loading rate limit for the reclaimed wastewater reuse operation as envisioned in the renewed permit is determined by the irrigation water requirement (IWR) for the crop grown based on the following formula:

$$IWR = [Cu - (PPT_e + \text{carry over soil moisture}) + LR]/E_i.$$

where: IWR is the irrigation water requirement or the hydraulic loading rate for the growing season
Cu is the crop consumptive use
PPT_e is the effective precipitation
LR is the leaching rate
E_i is the irrigation system efficiency

For permit purposes, the soil carry over moisture and leaching rate are assumed to be zero in calculating the IWR. Crop irrigation requirements are derived from data on the University of Idaho web site (http:///www.kimberly.uidaho.edu/water/appendxet/index.shtml) for the closest stations with suitable weather data, Parma Experiment Station –NWS and the Parma Agrimet Station. Precipitation deficit (P_{def}) data for alfalfa – less frequent cuttings was used. As stated on the web site, "P_{def} is synonymous with the net irrigation water requirement when occurring during the growing season for an irrigated crop." Based on that statement, P_{def} is considered to represent $Cu - PPT_e$. The "growing season" for the weather station data does not coincide with the growing season period defined in the permit. The following table adjusts the data to reflect the growing season period set forth in the permit (March 15 to October 31), averages it and then converts it from millimeters to inches.

		Precipitation Deficit for Alfalfa – Less Frequent Cuttings					
		Parma Exp Station NWS		Parma Agrimet			
Period	Days	Daily (mm/d)	Monthly (mm)	Daily (mm/d)	Monthly (mm)		
January	31	-0.38	-11.8	-0.37	-11.5		
February	28	0.17	4.8	0.27	7.6		
March 1-14	14	0.76	10.6	1.19	16.7		
March 15-31	17	0.76	12.9	1.19	20.2		
April	30	3.05	91.5	3.37	101.1		
May	31	5.26	163.1	4.39	136.1		
June	30	4.87	146.1	5.16	154.8		
July	31	5.38	166.8	5.32	164.9		
August	31	5.17	160.3	5.07	157.2		
September	30	3.25	97.5	3.85	115.5		
October	31	2.14	66.3	1.7	52.7		
November	30	-0.3	-9.0	0.09	2.7		
December	31	-0.48	-14.9	-0.21	-6.5	Average - mm	Average -inches
		Sum Annual	884.2		911.5	897.8	35.3
		Sum GS (3/15 - 10/31)	904.5		902.5	903.5	35.6
		Sum NGS	-20.3		8.9	-5.7	-0.2

The IWR is calculated as shown in the following table.

Fields	Area (acres)	IR[a] (inches)	E_i (%)	IWR (inches)	IWR (MG)[e]
CP-N, CP-S, and CP-17B	320	35.6 [b, c]	85	41.9	364
Pivot Corner Areas	37.1	35.6 [b, c]	80[d]	44.5	45

[a.] Irrigation Requirement
[b.] From previous table for "Sum GS (3/15 – 10/31)" average -inches
[c.] The previous staff analysis used an IR of 36.7 inches. One reason for the slight difference is that the Parma data was updated in 2004.
[d.] Changed from 75% in the previous staff analysis to reflect changes in irrigation methods for the corners.
[e.] Million gallons

Based on the above IWR data, approximately 409 million gallons (MG) of water will be needed to meet crop requirements. During the 2006 growing season, approximately 87.5 MG of reclaimed water was produced or about 20% of the total IWR. A large volume of supplemental irrigation water is required during the growing season to meet the IWR. Note that the estimated IWR of 409 MG is approximately 8% smaller that of the previous staff analysis.

Non-growing Season Hydraulic Loading Rates

The NGS hydraulic loading rate for the reclaimed wastewater reuse operation as envisioned in the renewed permit is determined by the following equation:

$$HLR_{ngs} = [AWC + (E - PPT_{ngs})]$$

where: HLR_{ngs} is the hydraulic loading rate for the non-growing season
AWC is the available water capacity of the soil
E is the estimated evapotranspiration during the non-growing season
PPT_{ngs} is the average precipitation for the non-growing season

The following table shows the recommended NGS hydraulic loading rates for Fields CP-N, CP-S, CP-17B and F-N and the Pivot Corner Areas

Field	Area acres	Soil AWC[a] inches	NGS[b] (ET-Precip)[c] inches	NGS Hydraulic Loading Rate, inches	NGS Hydraulic Loading Rate, MG[f]
CP-N	116	6	-0.2[d,e]	5.8	18.3
CP-S	116	6	-0.2[d,e]	5.8	18.3
CP-17B	88	6	-0.2[d,e]	5.8	13.9
F-N	36	6		5.8	5.7
Pivot Corner Areas	37.1	6		5.8	5.8
				Total	62.0[g]

[a.] Available Water-Holding Capacity – 6 inches per Wakagawa to Rau E-mail dated 2-20-2004
[b.] Non-growing season
[c.] Non-growing season evapotranspiration minus average precipitation
[d.] From Parma P_{def} table for "Sum NGS" average -inches
[e.] Greater than -0.96 inches used in previous staff analysis that used 2002 data for ET and 1996 data for precipitation
[f.] Million gallons
[g.] Increase by 6.2 MG; 11% greater than previous limit of 55.8 MG

SSI has proposed the use of alternative AWC values, and requested the opportunity to pursue the application of such values under the framework of the current permit, if sufficient verification/supporting data can be developed and approved for use by DEQ. DEQ has incorporated this request into the draft permit through compliance activity CA-095-07. This activity would allow SSI to re-evaluate the AWCs based upon field assessments and/or verification of previous field work, subject to DEQ concurrence and approval. The NGS hydraulic loading rate limit contains a re-opener clause linked to DEQ-approval of alternate AWC values, in accordance with CA-095-07.

Chemical Oxygen Demand Loading Rate

The chemical oxygen demand (COD) loading rate limit as envisioned in the renewed permit would be the same as in the current permit, 50 pounds per acre-day for both the growing and non-growing seasons.

Based on the information in the following table, the estimated actual COD loading rates for the growing and non-growing seasons would be 27.3 and 24.5 pounds per acre-day respectively, well below the envisioned limit. The estimated growing season loading rate includes contributions from both reclaimed wastewater and supplemental irrigation water.

Odor problems are sometime caused by COD, and the reclaimed wastewater reuse operation has experienced such problems in the past. However, since SSI installed aeration devices at the plant site and reuse site lagoons and took other measures, those problems have diminished considerably with no complaints having been made within the last several years. Since the odors did not appear to be the result

of COD loading rates on the fields, staff recommends the renewed permit to continue to limit COD to 50 pounds-acre-day during both the growing and non-growing seasons. Staff also recommends the renewed permit continue to require monitoring of the pretreatment efficiency of the DAF clarifier and dissolved oxygen levels in the lagoons

Parameter	Values
Total reclaimed water (RW)application area growing and non-growing seasons	357.1 acres (CP-N, CP-S, CP-17B and Corner Pivot Areas)
Growing season RW applied	87.5[a] million gallons (March 15 through October 31, 231 days)
Non-growing season RW applied	47.0[a] million gallons (November 1 through March 14, 134 days)
RW quality, Chemical Oxygen Demand (COD)	2,993[b] mg/l
Maximum Supplemental Irrigation (SI) applied	274.5 million gallons (IWR of 409 MG – total RW applied 134.5 MG)
SI quality, COD	30 mg/l[c]

[a.] Data for the 2005-2006 reporting period from Table 1 of Technical Report for Wastewater Land Application Permit Renewal, CSI-SSI Food services, LLC by Brockway Engineering PLLC dated December 20, 2007

[b.] Data for the 2005-2006 reporting period from Table 2 of Technical Report for Wastewater Land Application Permit Renewal, CSI-SSI Food services, LLC by Brockway Engineering PLLC dated December 20, 2007

c. Data (worse case) from Tables 3a and 3b of 2005-2006 Annual Report by Brockway Engineering PLLC dated March 2007

Total Nitrogen Loading Limit

The nitrogen loading limit envisioned for the renewed permit is the same as for the existing permit, 150% of typical crop uptake in pounds per acre-year from all sources including supplemental fertilizers. From Table 6 of the 2006 Annual Report, the average total nitrogen removal (prorated based on the areas of the large field without taking adjacent pivot corner areas into account) is 274 pounds per acre. One hundred and fifty percent (150%) of that uptake is 411 pounds per acre, the nitrogen loading limit.

Based on the information in the following table, the estimated actual nitrogen loading rates would be 235 pounds per acre, well below the envisioned limit. The estimated actual loading rate includes contributions from both reclaimed wastewater and supplemental irrigation water, but not from other sources such as fertilizer.

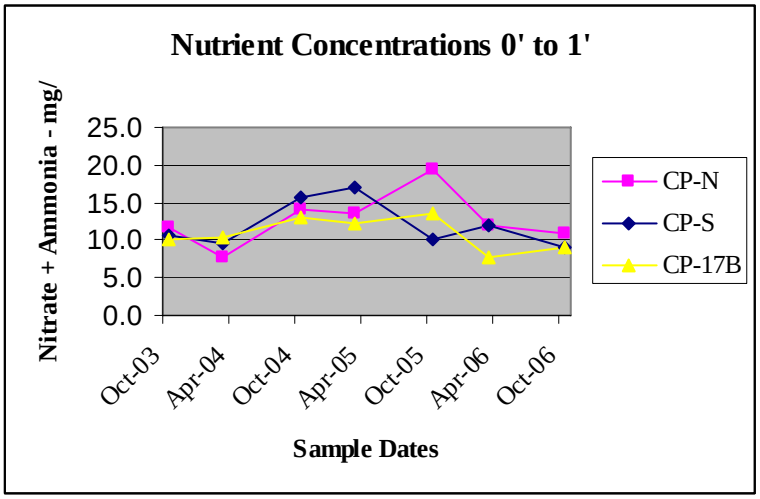
Parameter	Values
Total reclaimed water (RW)application area growing and non-growing seasons	357.1 acres (CP-N, CP-S, CP-17B and Corner Pivot Areas)
Growing season RW applied	87.5[a] million gallons (March 15 through October 31, 231 days)
Non-growing season RW applied	47.0[a] million gallons (November 1 through March 14, 134 days)
RW quality, Total Nitrogen (N)	72.3[b] mg/l
Maximum Supplemental Irrigation (SI) applied	274.5 million gallons (IWR of 409 MG – total RW applied 134.5 MG)
SI quality. N	1.3 mg/l[c]

[a.] Data for the 2005-2006 reporting period from Table 1 of Technical Report for Wastewater Land Application Permit Renewal, CSI-SSI Food services, LLC by Brockway Engineering PLLC dated December 20, 2007

[b.] Data for the 2005-2006 reporting period from Table 2 (TKN + Nitrate) of Technical Report for Wastewater Land Application Permit Renewal, CSI-SSI Food services, LLC by Brockway Engineering PLLC dated December 20, 2007

c. Data (worse case) from Tables 3a and 3b (TKN + Nitrate) of 2005-2006 Annual Report by Brockway Engineering PLLC dated March 2007

The following figure plots curves of nitrogen (nitrate plus ammonia) concentrations in the first foot of soil in the three main fields over time since 2003 (ammonia data not taken in 2002). Curves for the second foot of soil are similar. Although concentrations increased in 2004 and 2005, they returned to 2003 levels in 2006. No build-up of nitrogen in the soil appears to be occurring.



Staff recommends the renewed permit to continue to limit nitrogen loading to 150% of crop uptake.

Total Phosphorous Loading

The current permit does not include a phosphorous loading limit. It does require that phosphorus loading be monitored to avoid a build-up of excessive concentrations. Based on information in Table 6 of the 2006 Annual Report, the average total dry weight crop removal (prorated) was about 9,118 pounds per acre. From laboratory crop tissue testing results in the 2006 Annual Report, phosphorous is roughly 0.3% of the crop by dry weight, meaning that phosphorous uptake was roughly 27.4 pounds per acre.

Based on the information in the following table, the estimated actual phosphorous loading rate would be 78 pounds per acre. The estimated actual loading rate includes contributions from both reclaimed wastewater and supplemental irrigation water, but not from other sources such as fertilizer.

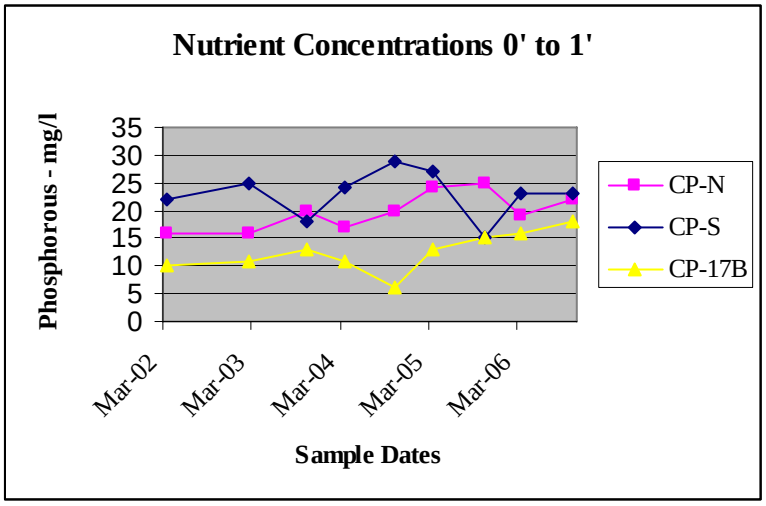
Parameter	Values
Total reclaimed water (RW)application area growing and non-growing seasons	357.1 acres (CP-N, CP-S, CP-17B and Corner Pivot Areas)
Growing season RW applied	87.5[a] million gallons (March 15 through October 31, 231 days)
Non-growing season RW applied	47.0[a] million gallons (November 1 through March 14, 134 days)
RW quality, Total Phosphorous (P)	24.5/l
Maximum Supplemental Irrigation (SI) applied	274.5 million gallons (IWR of 409 MG – total RW applied 134.5 MG)
SI quality. P	0.2/l[c]

[a.] Data for the 2005-2006 reporting period from Table 1 of Technical Report for Wastewater Land Application Permit Renewal, CSI-SSI Food services, LLC by Brockway Engineering PLLC dated December 20, 2007

[b.] Data for the 2005-2006 reporting period from Table 2 of Technical Report for Wastewater Land Application Permit Renewal, CSI-SSI Food services, LLC by Brockway Engineering PLLC dated December 20, 2007

c. Data (worse case) from Tables 3a and 3b of 2005-2006 Annual Report by Brockway Engineering PLLC dated March 2007

The following figure plots curves of phosphorous concentrations in the first foot of soil in the three main fields over time since 2002. These curves suggest a slow increase of phosphorous concentrations from approximately 15 mg/l in 2002 to 20 mg/l in 2006. Curves for the second foot of soil exhibit more variation, but show the same general trend.



In summary, the phosphorous loading rate is roughly 3 times the uptake rate and phosphorous soil concentrations are slowly increasing. However, as noted in the Groundwater discussion, site operations are having no observed effect on groundwater phosphorous concentrations. Because the buildup is slow and not affecting groundwater quality, staff does not recommend inclusion of a numerical limit at this time. Staff does recommend that all phosphorus monitoring requirements in the current permit be included in the renewed permit, as is further discussed under the Crop Uptake section on page 16 of this document. Staff also recommends including a provision in the renewed permit to allow it to be re-opened to address future phosphorus limitations and monitoring requirements, if necessary.

TDS and Other Related Constituent Loadings

The current permit does not include a loading limit for TDS or other related constituents. It does require that effluent downstream of the DAF be monitored quarterly for total dissolved inorganic solids (TDIS) and that the wastewater TDIS and supplemental irrigation non-volatile dissolved solids (NVDS) loading rates be calculated for each HMU annually. The objectives of these activities are not defined, and SSI has questioned the need to continue the TDIS monitoring or the TDIS and NVDS loading calculations.

Based on information provided in Tables 2a and 3a of the 2006 Annual Report, the average TDS concentrations of the reclaimed wastewater, supplemental irrigation water and canal water were 913, 493 and 87 mg/l respectively. Applying those concentrations to the total hydraulic loading rates in Table 4 of the 2006 Annual Report, total TDS loadings due to the wastewater (145 MG), supplemental irrigation water (230 MG) and canal water (27 MG) were (approximately) 1,101,000, 944,000 and 20,000 pounds respectively for a total on the order of 2 million pounds per year, or approximately 5,600 pounds per acre based on the new area of 357.1 acres.

Based on information in Tables 4 and 6 of the 2006 Annual Report, the total salt removed (which approximates TDS removed) by crop harvesting was 351,000 pounds or an average of 940 pounds per acre. Staff acknowledges that TDS dissipation can occur by other mechanisms besides crop removal, but notes that the loading rate is almost six times that of the crop removal rate.

Insufficient data is available to perform similar evaluations for sulfate and chloride, but staff suspects that these constituents also have high loading rates that are not adequately compensated for by crop removal and other mechanisms that have no adverse environmental effects.

As noted in the Groundwater discussion, groundwater TDS, sulfate and chloride concentrations appear to be either remaining constant or increasing slowly both up and down-gradient of the site. Additionally, the concentrations of these constituents increase while traversing beneath CP-N, CP-S and F-N (except chloride), but not CP-17B.

Staff believes that the increases in concentrations while the groundwater is transiting beneath the site are due at least in part to the high loading rates. Staff believes that the renewed permit should address the need for a more coherent approach towards monitoring the situation with regards to TDS, sulfate and chloride loadings and managing the operation as require to minimize the environmental effects of those loadings. Staff therefore recommends that the renewed permit delete previous requirements to monitor effluent for TDIS and to calculate TDIS and NVDS loadings, and include a compliance activity for developing a TDS and Related Constituents Management Plan. Staff also recommends continued evaluation of actual groundwater TDS, sulfate and chloride concentration data in light of GWQR standards and that the renewed permit include a provision to allow it to be re-opened to address future limitations for those constituents, if necessary.

Loading Rate Summary

The following table compares the projected actual loading rates based 2006 operational data to the proposed permit limits.

Constituent	Projected Loading Rate[a]	Limit in Draft Permit
GS COD[b]	27.3 pounds/acre-day	50 pounds/acre-day
NGS COD	24.5 pounds/acre-day	50 pounds/acre-day
Total Nitrogen	235 pounds/acre	150% of crop uptake (2006 Annual Report, 411 pounds/acre)
NGS HLR[c]	4.9 inches (47.0 million gallons)	5.8 inches (62.0 million gallons)
GS HLR[d] (320 acres)	36.8 inches (320.0 million gallons)[f]	41.9 inches (Irrigation Water Requirement)
GS HLR, Pivot Corner Areas (37.1 acres)	34.9 inches (35.2 million gallons)[f]	44.5 inches (Irrigation Water Requirement)
Phosphorus	78 pounds/acre (estimated uptake was 27.4 pounds/acre)	No numerical limit, re-opener recommended
TDS[e]	5,600 pounds/acre	No numerical limit, re-opener recommended

[a.] Based on even application of 357.1 acres using 2006 Annual Report wastewater and supplemental irrigation water quantity and quality data except as noted.
[b.] Chemical Oxygen Demand
[c.] Non-growing season hydraulic loading rate
[d.] Growing season hydraulic loading rate
[e.] Total Dissolved Solids
[f.] 2006 GS loading of 355.2 million gallon prorated between main fields and pivot corners based on size and HLR in inches

Crop Uptake

SSI has noted that the total nitrogen is the correct parameter to use for monitoring nitrogen uptake by the crop, and recommends that the renewed permit require plant tissue analysis for total nitrogen, not nitrate-nitrogen or Total Kjeldahl Nitrogen (TKN). Staff concurs with that suggestion.

As noted in the Groundwater discussion, the current groundwater situation suggests that such a calculation (or plant tissue analysis for phosphorous) may not be necessary; however, phosphorous loadings do exceed crop uptake (as is indicated in the Loading Limits discussion), meaning that a potential exists for the reuse operation to affect groundwater phosphorus concentrations. Staff recommends that the facility continue to conduct annual plant tissue analysis for phosphorus. Calculation of crop phosphorous removal is also required for every reporting year.

Site Management

Staff recommends the following plans, which were prepared and approved by DEQ as compliance activities in the existing permit, be incorporated by reference in the renewed permit.

1. *Plan of Operation* (also known as *Operation and Maintenance Manual* or *O&M Manual*)

2. *Nuisance Odor Management Plan*

3. *Buffer Zone Plan*

4. *Plan for Rehabilitation of Small Plant Site Lagoons* (if approved before the renewed permit becomes effective)

5. *F-N Land Management Plan*

Staff also recommends that the renewed permit include a compliance activity to review all of the plans incorporated by reference, update them as required and submit them for DEQ's approval. All operational plans (i.e., *Nuisance Odor Management Plan, Buffer Zone Plan,* and *F-N Land Management Plan*) will be incorporated into the Plan of Operation upon approval by DEQ.

Staff recommends that the renewed permit include a compliance activity to prepare a *Plan for Rehabilitation of Small Plant Site Lagoons* for DEQ's review and approval and to implement that plan in the event that work is not completed before the renewed permit becomes effective.

Staff recommends that the renewed permit include a compliance activity to conduct seepage testing of the active lagoons within 5 years of the previous seepage tests per IDAPA 58.01.08, Wastewater Rules § 493.02. The last seepage tests were in 2004, so the next tests are due in 2009.

Staff notes that the current permit does not appear to have a comprehensive *Solid Waste Management Plan*. Staff recommends that the renewed permit include a compliance activity to prepare such a plan for DEQ's review and approval. This plan will be incorporated into the Plan of Operation upon approval by DEQ.

A requirement in the current permit is for SSI to note the daily high and low temperatures and 24-hour precipitation for each HMU used for NGS application during the NGS. SSI has advised that it fulfills this requirement by using daily temperature and precipitation data from the USBR Agrimet station at Parma, located 7.7 miles from the reuse site. Staff recommends that the renewed permit clarify that using data from that station in place of on-site data is acceptable.

Recommendation

DEQ staff recommends that the attached land application draft renewal permit be issued. The draft renewal permit contains guideline loading limits for nitrogen, chemical oxygen demand, and GS/NGS hydraulic loading rates. Monitoring and reporting requirements to evaluate system performance and to determine permit compliance have been specified. Compliance activities, as recommended in the staff analysis, are incorporated into Section E of the permit.